CABINET DOOR PROP UNIT

BACKGROUND OF THE INVENTION

[Field of the Invention]

This invention relates to a cabinet door prop unit to be used for the door of a piece of storage furniture such as a storage cabinet, that may be an over- or under-the-top type door with a hinge mechanism, a pull-down-and-open type door, a pull-up-and-open type door, a swing-sideways type door or a door of any other relevant type as will be described hereinafter, in order to absorb the energy of the moving door and prevent it form slamming shut simply by fitting it to the door, on one hand, and also to the inner wall surface of one of the lateral walls, the top wall or the bottom wall, whichever appropriate, of the cabinet main body so that the door may be opened and closed easily, slowly and comfortably.

[Prior Art]

FIG. 18 of the accompanying drawings schematically illustrates a known under-the-top type cabinet door with a hinge mechanism, with which the door a can be opened and temporarily stored under the top wall c of the cabinet main body b (Japanese Utility Model Application Laid-Open No. 60-18528). Such a known door arrangement has the drawback that the door a has to be fitted and positionally regulated properly with toil because the slide mechanism of the door including a slide rail g and a roller h is located within the cabinet and the internal storage space of the cabinet main body b is reduced by the door a that is stored inside the cabinet main body b when it is opened in addition to the

fact that a support arm d and a short arm e have to be fitted to the door a and the cabinet main body b and a coil spring has to be arranged between the door a and the short arm e in order to make the door operate properly.

Additionally, the support arm d and the spring f become exposed to the outside to damage the appearance of the storage cabinet when the door a is opened and the user may have one or more than one of his or her fingers smashed between the spring f and the support arm d by mistake.

SUMMARY OF THE INVENTION

The present invention is intended to resolve the above identified problem and other problems of prior art cabinet doors. In the first aspect of the present invention, it is an object thereof to provide a cabinet door prop unit with a hinge mechanism for an over-the-top type cabinet door designed to be opened by turning the lower end thereof upward until it is placed on the top wall of the cabinet once the fitting case of the prop unit is rigidly fitted to the inner surface of one of the lateral walls of the cabinet and the distal end of the swing arm of the unit extending from the fitting case and swingable around an arm spindle is pivotably fitted to an anchor pin supported by an anchor pin bearing of the door.

Another object is to make the door prop unit comprise a movable spring holder constantly urged downward by a number of compression springs, a link arm pivotably fitted to the movable spring holder at the upper end thereof and to a base section of the swing arm swingable around the arm spindle at the lower end thereof by means of a

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link pin to transmit appropriate rotary force to the swing arm so that the door may be held to its closed position once it is closed and opened and stored easily on the top wall of the cabinet when only little force is applied thereto to open it by utilizing the resilient force of the compression springs. With such an arrangement, the door prop unit has a neat appearance and is free from the risk of smashed fingers because the compression springs and other components are not exposed to the outside.

In the second aspect of the invention, a cabinet door prop unit as described above in terms of the first aspect of the invention is provided with a damper mechanism for damping and slowing the swinging motion of the swing arm without requiring any user's effort when the cabinet door is closed.

In the third aspect of the invention, the resilient force of the compression springs of a cabinet door prop unit as described above in terms of the first aspect of the invention may be temporarily suspended for the convenience of the user so that the door may be stored on the top wall of the cabinet manually and slowly after it is fully opened and pulled out from the top wall also manually and slowly for closing it.

In the fourth aspect of the invention, a cabinet door prop unit according to the third aspect of the invention is provided with a damper mechanism for damping and slowing the swinging motion of the swing arm without requiring any user's effort when the cabinet door is closed so that the door may be prevented from slamming shut.

In the fifth aspect of the present invention, it is an object

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thereof to provide a cabinet door prop unit with a hinge mechanism for a pull-down-and open type cabinet door designed to be opened by pulling down the top of the door once the fitting case of the prop unit is rigidly fitted to the inner surface of one of the lateral walls of the cabinet and the distal end of the extension arm articulated at the proximal end thereof to the distal end of the swing arm of the unit extending from the fitting case and swingable around an arm spindle is pivotably fitted to an anchor pin supported by an anchor pin bearing of the door.

Another object is to make the door prop unit comprise a movable spring holder constantly urged upward by a number of compression springs, a link arm pivotably fitted to the movable spring holder at the lower end thereof and to a base portion of the swing arm at the upper end thereof by means of a link pin to transmit appropriate rotary force to the swing arm so that the door may be held to its closed position once it is closed by way of the extension arm and opened slowly when only appropriate force is applied thereto to open it by utilizing the resilient force of the compression springs. With such an arrangement, the door prop unit has a neat appearance and is free from the risk of smashed fingers because the compression springs and other components are not exposed to the outside.

In the sixth aspect of the invention, a cabinet door prop unit as described above in terms of the fifth aspect of the invention is provided with a damper mechanism for damping and slowing the swinging motion of the swing arm without requiring any user's effort when the cabinet door is opened.

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In the seventh aspect of the present invention, it is an object thereof to provide a cabinet door prop unit with a hinge mechanism for a pull-up-and-open type top cabinet door designed to be opened by pulling up the free end of the door once the fitting case of the prop unit is rigidly fitted to the inner surface of one of the lateral walls of the cabinet and the distal end of the extension arm articulated at the proximal end thereof to the distal end of the swing arm of the unit extending from the fitting case and swingable around an arm spindle is pivotably fitted to an anchor pin supported by an anchor pin bearing of the door.

Another object is to make the door prop unit comprise a movable spring holder constantly urged sideways by a number of compression springs, a link arm pivotably fitted to the movable spring holder at one of its opposite ends and to a base section of the swing arm at the other end thereof by means of a link pin to transmit appropriate rotary force to the swing arm so that the door may be held to its closed position once it is closed by way of the extension arm and opened slowly when only little force is applied thereto to open it by utilizing the resilient force of the compression springs. With such an arrangement, the door prop unit has a neat appearance and is free from the risk of smashed fingers because the compression springs and other components are not exposed to the outside.

In the eighth aspect of the invention, a cabinet door prop unit as described above in terms of the seventh aspect of the invention is provided with a damper mechanism for slowing and damping the swinging motion of the swing arm without requiring any user's effort

when the cabinet door is closed from its open position.

In the ninth aspect of the present invention, it is an object thereof to provide a cabinet door prop unit with a hinge mechanism for a pull-up-and-open type front side cabinet door designed to be opened by pulling up the free end of the door once the fitting case of the prop unit is rigidly fitted to the inner surface of one of the lateral walls of the cabinet and the distal end of the extension arm articulated at the proximal end thereof to the distal end of the swing arm of the unit extending from the fitting case and swingable around an arm spindle is pivotably fitted to an anchor pin supported by an anchor pin bearing of the door.

Another object is to make the door prop unit comprise a movable spring holder constantly urged upward by a number of compression springs, a link arm pivotably fitted to the movable spring holder at the lower end thereof and to a base section of the swing arm at the upper end thereof by means of a link pin to transmit appropriate rotary force to the swing arm so that the door may be held to its closed position once it is closed by way of the extension arm and opened fully by the resilient force of the compression springs without requiring much force on the part of the user once the door is opened to a small extent. Additionally, the door can constantly be held to its open position by the compression springs once the door is opened to make the swing arm and the extension arm aligned relative to each other. With such an arrangement, the door prop unit has a neat appearance and is free from the risk of smashed fingers because the compression springs and other components are not exposed to the outside.

In the tenth aspect of the invention, a cabinet door prop unit as described above in terms of the ninth aspect of the invention is provided with a damper mechanism for slowing and damping the swinging motion of the swing arm without requiring any user's effort when the cabinet door is closed from its open position.

In the eleventh aspect of the invention, it is an object to provide a cabinet door prop unit with a hinge mechanism for a cabinet pull-sideways-and open type door designed to be opened and closed in an easy way as described above by appropriately arranging compression springs, a movable spring holder, a link arm, an arm spindle, a swing arm, a pivot pin, a link pin and other components such that the door may be held to its closed position whereas it may be opened and held to its fully open position with little effort due to the resilient force of the compression springs. With such an arrangement, the door prop unit has a neat appearance and is free from the risk of smashed fingers because the compression springs and other components are not exposed to the outside. In the twelfth aspect of the invention, a cabinet door prop unit as described above in terms of the eleventh aspect of the invention is provided with a damper mechanism for damping and slowing the swinging motion of the swing arm without requiring any user's effort.

The thirteenth aspect of the present invention relates to a cabinet door prop unit with a hinge mechanism for a pull-up-and-store-under-the-door type front side cabinet door as in the fitting case of the ninth aspect of the invention, although the door can be not only opened by pulling up the lower free end of the door but also stored under

the top wall of the cabinet simply by pushing it into the cabinet once the door is turned upward to a horizontal position.

Here, the fitting case of the prop unit is fitted not directly to the inner surface of one of the lateral walls of the cabinet but rigidly to a bracket that is horizontally slidable along a sliding rail assembly having an outer rail and an inner rail and arranged on the inner surface of the lateral wall in such a way that the bracket and the door are articulated by means of not a simple hinge mechanism but a sliding hinge mechanism and the swing arm extending from the fitting case and swingable around an arm spindle is articulated further to an extension arm so that the under-the-top type door may be operated with ease once the distal end of the extension arm is pivotably fitted to an anchor pin supported by an anchor pin bearing of the door.

Another object is to make the door prop unit adapted to transmit appropriate rotary force to the swing arm in order to make it held to its closed position once it is closed by way of the extension arm and fully opened by the resilient force of the compression springs without requiring much force on the part of the user once the door is opened to a small extent. Additionally, the door can constantly be held to its open position by the compression springs and the sliding hinge mechanism and the door can be pushed into the cabinet smoothly by means of the slide rails and the bracket once the door is opened to make the swing arm and the extension arm aligned relative to each other.

In the fourteenth aspect of the invention, a cabinet door prop unit as described above in terms of the thirteenth aspect of the invention

is provided with a damper mechanism for damping and slowing the swinging motion of the swing arm without requiring any user's effort as in the fitting case of the tenth aspect of the invention, wherein the cabinet door prop unit according to the ninth aspect of the invention is provided with a damper mechanism. According to the present invention, the above described objects of the first aspect are achieved by providing an over-the-top type cabinet door prop unit characterized in that it comprises a fitting case to be rigidly fitted to the inner surface of one of the lateral walls of the cabinet, a movable spring holder vertically movable relative to the fitting case containing it and urged downward by compression springs, a link arm pivotably linked at the upper end to the movable spring holder by means of a pivot pin and a swing arm swingable around an arm spindle located in a lower portion of the fitting case and having a base section arranged around the arm spindle and linked to the lower end of said link arm by means of a link pin and an arm section extending from the base section and pivotably linked at the distal end thereof by means of an anchor pin to an anchor pin bearing secured to the over-the-top type cabinet door and that the pivot where the link arm and the base section of the swing arm is linked by means of the link pin is located closer to the cabinet door relative to the vertical axial line connecting said pivot pin and said arm spindle when the over-the-top type cabinet door is closed and moved onto said vertical axial line in the initial stages of the opening motion of the cabinet door and then further away from the cabinet door relative to said vertical axial line in the subsequent stages of the opening motion of the cabinet door until the

cabinet door is placed on the top wall of the cabinet.

The object of the second aspect of the invention are achieved by providing an over-the-top type cabinet door prop unit described above in terms of the first aspect and characterized further in that said arm spindle is linked to the rotary shaft of a damper mechanism arranged in the fitting case and designed to exert a damping effect on the closing or closing and opening motion of the cabinet door by means of viscous fluid.

According to the third aspect of the invention, there is provided an over-the-top type cabinet door prop unit having a configuration according to the first aspect of the invention and characterized further in that the pivot where the link arm and the base section of the swing arm is linked by means of the link pin is located closer to the cabinet door relative to the vertical axial line connecting said pivot pin and said arm spindle when the over-the-top type cabinet door is closed and moved onto said vertical axial line in the initial stages of the opening motion of the cabinet door and then further away from the cabinet door relative to said vertical axial line in the subsequent stages of the opening motion of the cabinet door down to the final stages of the opening motion of the cabinet door and that a vertical slot is arranged within said movable spring holder in such a way that said downwardly urging motion of said compression springs is blocked at a limit by the fitting case and the pivotal position of the pivot pin may be lowered by a required length from the original upper pivotal position as the cabinet door is opened by hand in the final stages of the opening motion of the cabinet door until

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the cabinet door is placed on the top wall of the cabinet.

According to the fourth aspect of the invention, there is provided an over-the-top type cabinet door prop unit according to the third aspect of the invention and characterized further in that said arm spindle is linked to the rotary shaft of a damper mechanism arranged in the fitting case and designed to exert a damping effect on the closing or closing and opening motion of the cabinet door by means of viscous fluid.

According to the fifth aspect of the invention, there is provided a pull-down-and-open type cabinet door prop unit characterized in that it comprises a fitting case to be rigidly fitted to the inner surface of one of the lateral walls of the cabinet, a movable spring holder vertically movable relative to the fitting case containing it and urged upward by compression springs, a link arm pivotably linked at the lower end to the movable spring holder by means of a pivot pin, a swing arm swingable around an arm spindle located in an upper portion of the fitting case and having a base section arranged around the arm spindle and linked to the upper end of said link arm by means of a link pin and an arm section extending from the base section and an extension arm linked at the proximal end to the distal end of said swing arm by means of a joint pin so as to be adapted to become aligned with said arm section or pivotable therefrom toward the opening of the cabinet and pivotably linked at the distal end thereof by means of an anchor pin to an anchor pin bearing secured to the pull-down-and-open type cabinet door and that the pivot where the link arm and the base section of the swing arm are linked by

means of the link pin is located closer to the cabinet door relative to the vertical axial line connecting said pivot pin and said arm spindle and the arm section when the extension arm are oblique relative to each other to expand said compression springs the pull-down-and-open type cabinet door is closed, whereas said pivot is located substantially on said vertical axial line and the arm section and the extension arm are aligned as the movable spring holder is moved downward when the cabinet door hinged to the corresponding edge of the bottom wall of the cabinet is opened and made flush with the bottom wall.

According to the sixth aspect of the invention, there is provided a pull-down-and-open type cabinet door prop unit according to the fifth aspect of the invention and characterized further in that said arm spindle is linked to the rotary shaft of a damper mechanism arranged in the fitting case and designed to exert a damping effect on the closing or closing and opening motion of the cabinet door by means of viscous fluid.

According to the seventh aspect of the invention, there is provided a pull-up-and-open type top cabinet door prop unit characterized in that it comprises a fitting case to be rigidly fitted to the inner surface of one of the lateral walls of the cabinet, a movable spring holder horizontally movable relative to the fitting case containing it and urged toward the front wall of the cabinet by compression springs, a link arm pivotably linked at the end close to the rear wall of the cabinet to the movable spring holder by means of a pivot pin, a swing arm swingable around an arm spindle located in a portion of the fitting case close to the

front wall of the cabinet and having a base section arranged around the arm spindle and linked to the end of said link arm close to the front wall of the cabinet by means of a link pin and an arm section extending from the base section and an extension arm linked at the proximal end to the distal end of said swing arm by means of a joint pin so as to be adapted to become aligned with said arm section or pivotable therefrom toward the opening of the cabinet and pivotably linked at the distal end thereof by means of an anchor pin to an anchor pin bearing secured to the pull-up-and-open type top cabinet door and that the pivot where the link arm and the base section of the swing arm is linked by means of the link pin is located between the pivot pin and the arm spindle and slightly away from the cabinet door relative to the horizontal axial line connecting said pivot pin and said arm spindle when the arm section and the extension arm are oblique relative to each other to compress said compression springs and the pull-up-and-open type top cabinet door is closed, whereas said pivot is located closer to the front wall of the cabinet relative to the arm spindle and away from the cabinet door relative to the horizontal axial line connecting said pivot pin and said arm spindle and the arm section and the extension arm are aligned and project upward to expand said compression springs as the movable spring holder is moved away from the cabinet door relative to said horizontal axial line when the pull-up-and-open type top cabinet door hinged to the upper edge of the rear wall of the cabinet is opened.

According to the eighth aspect of the invention, there is provided a pull-up-and-open type top cabinet door prop unit according to

the seventh aspect of the invention and characterized further in that said arm spindle is linked to the rotary shaft of a damper mechanism arranged in the fitting case and designed to exert a damping effect on the closing or closing and opening motion of the cabinet door by means of viscous fluid.

According to the ninth aspect of the invention, there is provided a pull-up-and-open type cabinet door prop unit characterized in that it comprises a fitting case to be rigidly fitted to the inner surface of one of the lateral walls of the cabinet, a movable spring holder vertically movable relative to the fitting case containing it and urged downward by compression springs, a link arm pivotably linked at the upper end to the movable spring holder by means of a pivot pin, a swing arm swingable around an arm spindle located in a lower portion of the fitting case and having a base section arranged around the arm spindle and linked to the lower end of said link arm by means of a link pin and an arm section extending from the base section and an extension arm linked at the proximal end to the distal end of said swing arm by means of a joint pin so as to be adapted to become aligned with said arm section or pivotable therefrom toward the opening of the cabinet and pivotably linked at the distal end thereof by means of an anchor pin to an anchor pin bearing secured to the pull-up-and-open type cabinet door and that the pivot where the link arm and the base section of the swing arm are linked by means of the link pin is located closer to the cabinet door relative to the vertical axial line connecting said pivot pin and said arm spindle when the arm section and the extension arm are oblique relative to each other

to compress said compression springs and the pull-up-and-open type cabinet door is closed, whereas said pivot is moved substantially onto said vertical axial line connecting said pivot pin and said arm spindle in the initial stages of opening the cabinet door hinged to the corresponding upper edge of the top wall and then further away from the cabinet door relative to said vertical axial line in the subsequent stages of opening the cabinet door until the arm section and the extension arm are aligned to expand the compression spring and complete the door opening operation.

According to the tenth aspect of the invention, there is provided a pull-up-and-open type cabinet door prop unit according to the ninth aspect of the invention and characterized further in that said arm spindle is linked to the rotary shaft of a damper mechanism arranged in the fitting case and designed to exert a damping effect on the closing or closing and opening motion of the cabinet door by means of viscous fluid.

According to the eleventh aspect of the invention, there is provided a pull-sideways-and-open type cabinet door prop unit characterized in that it comprises a fitting case to be rigidly fitted to the inner surface of either the top wall of the bottom wall of the cabinet, a movable spring holder horizontally movable relative to the fitting case containing it and urged toward the front wall of the cabinet door by compression springs, a link arm pivotably linked at the end close to the rear wall of the cabinet to the movable spring holder by means of a pivot pin, a swing arm swingable around an arm spindle located in a portion of the fitting case close to the front wall of the cabinet and having a base

section arranged around the arm spindle and linked to the end of said link arm close to the front wall of the cabinet by means of a link pin and an arm section extending from the base section and an extension arm linked at the proximal end to the distal end of said swing arm by means of a joint pin so as to be adapted to become aligned with said arm section or pivotable therefrom toward the opening of the cabinet and pivotably linked at the distal end thereof by means of an anchor pin to an anchor pin bearing secured to the pull-sideways-and-open type cabinet door and that the pivot where the link arm and the base section of the swing arm are linked by means of the link pin is located closer to the cabinet door relative to the horizontal axial line connecting said pivot pin and said arm spindle when the arm section and the extension arm are oblique relative to each other to expand said compression springs and the pull-sideways-and-open type cabinet door is closed, whereas said pivot is moved substantially onto said horizontal axial line connecting said pivot pin and said arm spindle in the initial stages of opening the cabinet door hinged to the corresponding upper edge of the top wall to compress said compression springs and then further away from the cabinet door relative to said horizontal axial line in the subsequent stages of opening the cabinet door until the arm section and the extension arm are aligned to expand the expand spring and complete the door opening operation.

According to the twelfth aspect of the invention, there is provided a pull-sideways-and-open type top cabinet door prop unit according to the eleventh aspect of the invention and characterized further in that said arm spindle is linked to the rotary shaft of a damper

mechanism arranged in the fitting case and designed to exert a damping effect on the closing or closing and opening motion of the cabinet door by means of viscous fluid.

According to the thirteenth aspect of the invention, there is provided a pull-up-and-store-under-the-top type cabinet door prop unit designed for the cabinet door to be pulled up to a horizontal position, pushed into the cabinet and stored under the top wall of the cabinet by means of a bracket horizontally movable along a sliding rail assembly arranged on the inner surface of one of the lateral walls of the cabinet and pivotably linked by means of a sliding hinge mechanism to the inner surface of a top portion of the cabinet door fitted into the opening of the cabinet, characterized in that it comprises a fitting case to be rigidly fitted to said bracket, a spring holder vertically movable relative to the fitting case containing it and urged downward by compression springs, a link arm pivotably linked at the upper end to the movable spring holder by means of a pivot pin, a swing arm swingable around an arm spindle located in a lower portion of the fitting case and having a base section arranged around the arm spindle and linked to the lower end of said link arm by means of a link pin and an arm section extending from the base section and an extension arm linked at the proximal end to the distal end of said swing arm by means of a joint pin so as to be adapted to become aligned with said arm section or pivotable therefrom toward the opening of the cabinet and pivotably linked at the distal end thereof by means of an anchor pin to an anchor pin bearing secured to the pull-up-and-store-under-the-top type cabinet door and that the pivot where

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the link arm and the base section of the swing arm are linked by means of the link pin is located closer to the cabinet door relative to the vertical axial line connecting said pivot pin and said arm spindle when the arm section and the extension arm are oblique relative to each other, whereas said pivot is moved substantially onto said vertical axial line in the initial stages of opening the cabinet door linked to the bracket by way of the sliding hinge mechanism and then further away from the cabinet door relative to said vertical axial line in the subsequent stages of opening the cabinet door until the arm section and the extension arm are aligned to expand the compression spring and complete the door opening operation.

According to the fourteenth aspect of the invention, there is provided a pull-up-and-store-under-the-top type cabinet door prop unit designed for the cabinet door to be pulled up to a horizontal position, pushed into the cabinet and stored under the top wall of the cabinet by means of a bracket horizontally movable along a sliding rail assembly arranged on the inner surface of one of the lateral walls of the cabinet and pivotably linked by means of a sliding hinge mechanism to the inner surface of a top portion of the cabinet door fitted into the opening of the cabinet, characterized in that it comprises a fitting case to be rigidly fitted to said bracket, a spring holder vertically movable relative to the fitting case containing it and urged downward by compression springs, a link arm pivotably linked at the upper end to the movable spring holder by means of a pivot pin, a swing arm swingable around an arm spindle located in a lower portion of the fitting case and having a base section arranged around the arm spindle and linked to the lower end of said link

arm by means of a link pin and an arm section extending from the base section and an extension arm linked at the proximal end to the distal end of said swing arm by means of a joint pin so as to be adapted to become aligned with said arm section or pivotable therefrom toward the opening of the cabinet and pivotably linked at the distal end thereof by means of an anchor pin to an anchor pin bearing secured to the pull-up-and-store-under-the-top type cabinet door, that the pivot where the link arm and the base section of the swing arm are linked by means of the link pin is located closer to the cabinet door relative to the vertical axial line connecting said pivot pin and said arm spindle when the arm section and the extension arm are oblique relative to each other, whereas said pivot is moved substantially onto said vertical axial line in the initial stages of opening the cabinet door linked to the bracket by way of the sliding hinge mechanism and then further away from the cabinet door relative to said vertical axial line in the subsequent stages of opening the cabinet door until the arm section and the extension arm are aligned to expand the compression spring and complete the door opening operation and that said arm spindle is linked to the rotary shaft of a damper mechanism arranged in the fitting case and designed to exert a damping effect on the closing or closing and opening motion of the cabinet door by means of viscous fluid.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partly cut-away schematic lateral view of an over-the-top type cabinet door prop unit according to the invention in the closed state.

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FIG. 2 is a partly cut-away schematic lateral view of the over-the-top type cabinet door prop unit of FIG. 1 in a initial stage of the door opening motion.

FIG. 3 is a partly cut-away schematic lateral view of the over-the-top type cabinet door prop unit of FIG. 1 in a subsequent stage of the door opening motion.

FIG. 4 is a partly cut-away schematic lateral view of the over-the-top type cabinet door prop unit of FIG. 3 in the final stage of the door opening motion.

FIG. 5 is an exploded perspective view of the damper mechanism of the over-the-top type cabinet door prop unit of FIG. 1

FIGS. 6A and 6B are partly cut-away schematic lateral views of an over-the-top type cabinet door prop unit according to the fifth or sixth aspect of the invention in the closed state and in the open state respectively.

FIG. 7 is an exploded perspective view of the damper mechanism of a cabinet door prop unit according to any of the fifth through fourteenth aspects of the invention.

FIGS. 8A and 8B are partly cut-away schematic lateral views of an pull-up-and-open type top cabinet door prop unit according to the seventh or eighth aspect of the invention in the closed state and in the open state respectively.

FIG. 9 is a partly cut-away schematic lateral view of an pull-up-and-open type cabinet door prop unit according to the seventh or eighth aspect of the invention in the closed state.

FIG. 10 is a partly cut-away schematic lateral view of the pull-up-and-open type cabinet door prop unit of FIG. 9 in a initial stage of the door opening motion.

FIG. 11 is a partly cut-away schematic lateral view of the pull-up-and-open type cabinet door prop unit of FIG. 9 in the final stage of the door opening motion.

FIG. 12 is a partly cut-away schematic lateral view of an pull-sideways-and-open type cabinet door prop unit according to the seventh or eighth aspect of the invention in the closed state.

FIG. 13 is a partly cut-away schematic lateral view of an pull-sideways-and-open type cabinet door prop unit of FIG. 12 in a state where the door is being opened.

FIG. 14 is a partly cut-away schematic lateral view of an pull-sideways-and-open type cabinet door prop unit of FIG. 12 in the final stage of the door opening motion.

FIG. 15 is a partly cut-away schematic lateral view of an pull-up-and-store-under-the type cabinet door prop unit according to the thirteenth or fourteenth aspect of the invention in the closed state.

FIG. 16 is a partly cut-away schematic lateral view of an pull-up-and-store-under-the type cabinet door prop unit of FIG. 15 in the final stage of the door opening motion.

FIG. 17 is a partly cut-away schematic lateral view of an pull-up-and-store-under-the type cabinet door prop unit of FIG. 16 as viewed from the opposite direction.

FIG. 18 is a schematic lateral view of a known over-the-top

type cabinet door prop unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, the present invention will be described by referring to the accompanying drawings that illustrate preferred embodiments of the invention. FIGS. 1 through 5 shows an embodiment of over-the-top type cabinet door according to either the first or the second aspect of the invention. Referring to FIGS. 1 through 5, a hinge 1d is fitted at an end thereof to the front edge 1c of the top wall 1b of a storage cabinet 1a and rigidly secured at the other end thereof to the inner rail 1g of a sliding rail assembly 1f. Thus, the door 1e can be swung open around the joint pin 1h of the hinge 1d by pulling up the lower end of the door 1e and then stored on the top wall 1b by pushing the door 1e forward to make the outer rail 1i of the sliding assembly slide relative to the inner rail 1g.

Both the first and second aspects of the invention relates to a door prop unit of an over-the-top type cabinet door D as described above that allows the cabinet door to be opened and closed very smoothly. As seen from FIGS. 1 and 5, the unit comprises a fitting case 3 to be rigidly secured to the inner surface of an upper portion of one of the lateral walls, or the lateral wall 1j, located close to the opening 1k of the cabinet 1a and a movable spring holder 5 contained in the fitting case 3 in such a way that it is vertically movable relative to the fitting case 3 and constantly urged downward by a number of compression springs 4 also contained in the fitting case 3.

The fitting case 3 shown in FIG. 5 includes a reinforcing cover plate 3a to be fitted to the inner surface of the lateral wall 1j and a fitting

case main body 3b fitted into the cover plate 3a, of which the reinforcing cover plate 3a is provided with fitting holes 3c for allowing respective screws 2 to pass therethrough as shown in FIG. 1 and through holes 3d bored through the top wall section 3e of the reinforcing cover plate 3a, while the fitting case main body 3b is provided with threaded holes 3f bored through an end of the top wall section 3g of the fitting case main body 3b so that the fitting case 3 may be assembled by placing the fitting case main body 3b into the reinforcing cover plate 3a and binding them together by means of screws that are driven into the through holes 3d and the threaded holes 3f respectively.

Referring further to FIG. 5, the reinforcing cover plate 3a has lateral wall sections 3h extending downward from the opposite ends of the top wall section 3e along the fitting rear wall section 3i, whereas the fitting case main body 3b has its own lateral wall sections 3j also extending downward from the opposite ends of the wall section 3g along the fitting front wall section 3k. Thus, a closed space 3m is defined within the fitting case main body to vertically movably contain the movable spring holder 5 therein.

The lateral wall sections 3h of the reinforcing cover plate 3a are provided with respective through holes 3n, whereas the lateral wall sections 3j of the fitting case main body 3b are provided with respective through holes 3p to allow a spring anchoring rod 3q to pass therethrough and be rigidly held there, against which compression springs 4a pressed at the upper ends thereof.

The movable spring holder 5 will be described in greater detail

by referring to FIG. 5. It comprises a front wall 5a, a rear wall 5b and lateral walls 5c to define a box-shaped profile having a top opening and is also provided with a pair of internal partition walls 5d to define three oblong rectangularly parallelepipedic spaces 5e for allowing respective compression springs to pass therethrough along with the paired lateral walls 5c. The three compression 4 contained in the respective spaces are pressed against the spring anchoring rod 3q at the top thereof and against a spring receiving rod 5f secured horizontally to the lateral walls 5c of the movable spring holder 5.

Thus, the movable spring holder 5 is housed in the closed space 3m and vertically movable within it either upwardly to compress the compression springs 4 or downwardly to expand the compression springs 4 as its lateral walls 5c slide along the respective inner surfaces of the corresponding lateral walls sections 3j of the fitting case 3.

Referring further to FIG. 5 for the third and fourth aspects of the invention, it also shows a guide groove 3r on the inner surface of each of the lateral wall sections 3j that is engaged with the corresponding lateral wall 5c of the movable spring holder 5 to make the latter move smoothly in the vertical direction so that the movable spring holder 5 eventually abuts a stopper member 3s arranged at the lower end of the guide groove 3r as it moves downward and the downward movement of the movable spring holder 5 is blocked there. Under this condition, the resilient force of the compression springs 4 is not transmitted to the downstream members any more.

Then, a link arm 6 is arranged in a lower portion of the fitting

case 3 and pivotably linked at the upper end thereof to the movable spring holder 5 by means of a pivot pin 6a and at the lower end thereof to the base section 7b of a swing arm 7 formed around an arm spindle 7a by means of a link pin 6b. An arm section 7c of the swing arm 7 is extending from the base section 7b and the distal end of the arm section 7c is pivotably linked by way of an anchor pin 7d to an anchor pin bearing 8 that is rigidly secured to the door 1e.

Referring to FIG. 5 for the third and fourth aspects of the invention, the front wall 5a and the rear wall 5b of the movable spring holder 5 are provided at respective lower central areas thereof with respective vertical slots 5g for movably holding the pivot pin 6a for the link arm 6 in stead of holes for receiving the pivot pin 6a, the vertical slots 5b being open at the respective lower ends. The swing arm 7 is provided with a gap 7e running vertically at the middle of the width so that the lower end of the link arm 6 is inserted into the gap 7e and pivotably linked to the base section 7b of the swing arm 7 by means of a link pin 6b without altering the relationship of the arm section 7c, the anchor pin bearing 8 and the anchor pin 7d.

In FIG. 5, the relationship between the swing arm 7 and the arm spindle 7a is such that engaging projections 7f of the arm spindle 7a are engaged respectively with corresponding engaging recesses 7h of the spindle hole 7g formed through the base section 7b of the swing arm 7 in order to transmit the rotary motion of the swing arm 7 to the arm spindle 7a. For the second and fourth aspects of the invention, the arm spindle 7a is coaxially linked to the rotary shaft 9a of the damper mechanism 9

arranged in a lower portion of the fitting case 3.

Thus, referring to FIG. 5, as the swing arm 7 is swung, the closing or opening motion of the cabinet door 1e is damped by the damping effect of the viscous fluid contained in the damper mechanism 9 as will be described in greater detail hereinafter. The damper mechanism 9 itself illustrated in FIG. 5 is known and comprises a damper bearing section 9b arranged in a lower portion of the fitting case main body 3b, a movable disc 9c fitted to the rotary shaft 9a, a stationary disc 9d arranged adjacent to the movable disc 9c and blocked against any rotary motion, a pair of O-rings 9e and 9f and a lid 9g secured to the reinforcing cover plate 3a by means of a screw (not shown) driven into it through a screw bore 3t. What is important with the damper mechanism 9 having a configuration as described above is the selection of the pivotal point P at which the lower end of the link arm 6 is linked to the base section 7b of the swing arm 7 by means of a link pin 6b.

For the first and second aspects of the invention, the pivotal point P is located closer to the door 1e relative to the vertical axial line L connecting the pivot pin 6a and the arm spindle 7a when the cabinet door is closed as shown in FIG. 1. As seen from FIG. 1, the compression springs 4 are in a compressed state under this condition in an over-the-top type door prop unit according to the first aspect of the invention so that a downwardly directed force is applied to the link arm 6 under the resilient effect of the compression spring 4. Thus, the base section 7b of the swing arm 7 is subjected to a rotary force in the direction of arrow R1 at the pivotal point P and, consequently, the arm

section 7c is forced to rotate in the direction of arrow R2 so that the door 1e is held to the closed position and would not be inadvertently opened. Then, as the door 1e is turned upward and opened by hand from the closed state shown in FIG. 1, holding the lower end of the door 1e, the pivotal point P is turned counterclockwise until it is located on the vertical axial line L as shown in FIG. 2 to provide a change point there in the initial stages of the door opening motion. As the door is further opened, it comes into the subsequent stages as shown in FIG. 3, where the pivotal point P is turned away from the door 1e relative to the vertical axial line L so that the resilient force of the compression springs 4 urges the base section 7b to rotate in the direction of arrow R3 that is opposite to the direction of arrow R1 and the swing arm 7 is turned along the direction of arrow R4 to further open the door. Therefore, the user can open the door 1e until it is stored on the top wall 1b with little effort by utilizing the resilient force of the compression springs 4. For closing the door 1e stored on the top wall 1b, the user only has to pull down the door 1e for the initial stages of the closing motion. Thereafter, the door 1e moves down by itself due to its own weight if the user releases the door. Note that, under this condition, the door 1e is closed very slowly until it gets to the completely closed position of FIG. 1 under the buffering effect of the compression springs 4 because the compression springs 4 are gradually compressed from their expanded state to exert their resilient force. Once the door 1e is completely closed, it is held to that state as described above. An over-the-top type cabinet door prop unit according to the second aspect of the invention is realized by adding

a damper mechanism 9 to a door prop unit according to the first aspect of the invention. If the damper mechanism 9 is arranged in such a way that its damping effect is exerted by means of a one-way clutch (not shown) only when the door is being closed, then the door closing motion can be made more slowly and smoothly than that of the door according to the first aspect of the invention.

The damper mechanism may alternatively be so arranged that its damping effect can be utilized for both the closing motion and the door opening motion. If such is the case, while the resilient force of the compression springs 4 for increasing the door closing effect is reduced by the damping effect of the damper mechanism when the door is opened, this disadvantage can be minimized by maximizing the resilient force to be used for increasing the door closing effect. It may be needless to say that the use of a one-way clutch is not necessary in this case.

With a over-the-top type cabinet door prop unit according to the third aspect of the invention, it gets into the initial stages of the door opening motion from the closed state shown in FIG. 1 when it passes the change point of FIG. 2 as in the case of its counterpart according to the first aspect of the invention. Under this condition, the pivotal point P is moved away from the door relative to the vertical axial point L to allow the resilient force of the compression springs 4 to accelerate the door opening motion until the door prop unit gets into the subsequent stages of the door opening motion shown in FIG. 3. However, the door prop unit according to the third aspect of the invention differs from its counterpart described above for the first aspect of the invention in that, once it gets

into the subsequent stages of the door opening motion, the movable spring holder 5 that has been pushed down by the compression springs 4 abuts the stopper members 3s in the guide grooves 3r to make the resilient force of the compression springs 4 ineffective for rotating the swing arm 7.

As a result, the door prop unit 1e is totally free now so that it can easily be pushed onto the top wall 1b of the cabinet door from the position shown in FIG. 3. Now, the movable spring holder 5 of the cabinet door prop unit according to the third aspect of the invention is provided with vertical slots 5g and, while the pivot pin 6a is located at the top of the vertical slots 5g in FIG. 3, it moves down along the vertical slots 5g as the door is opened by hand so that the user can push the door 1e onto the top wall 1b until it is squarely placed on the top wall 1b as the outer rail 1i is slidingly moved relative to the inner rail 1g.

A door prop unit according to the fourth aspect of the invention is realized by adding a damper mechanism 9 to a door prop unit according to the third aspect of the invention and, therefore, its effects are substantially same as those described above by referring to the second aspect of the invention.

Now, a pull-down-and-open type cabinet door prop unit according to the fifth aspect of the invention will be described by referring to FIGS. 6A and 6B. With the pull-down-and-open type door D1, the door proper 1e is swingably fitted to the front edge 1n of the bottom wall 1m of the cabinet main body 1a to close the opening 1k by means of a hinge 1d. Thus, the door 1e can be turned from its upright

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closed position shown in FIG. 6A to the opened position as shown in FIG. 6B, where the door 1e of the pull-down-and-open door D1 is substantially flush with the bottom wall 1m of the cabinet main body 1a.

Thus, as shown in FIGS. 6A, 6B and 7, the pull-down-and-open type cabinet door prop unit of the fifth aspect of the invention comprises a fitting case 3 rigidly secured to a lower portion of the inner surface of one of the lateral walls 1j of the door main body 1a at a position close to the opening 1k by means of screws 2 and a fitting case 3 housed in the fitting case 3 in such a way that it is vertically movable relative to the fitting case 3 and urged upward by means compression springs 4.

As seen from FIG. 7, the fitting case 3 has a configuration substantially similar to that of its counterpart of FIG. 5. Therefore, the components similar to those of FIG. 5 are denoted respectively by the same reference symbols. However, the fitting case 3 of FIG. 7 differs from that of FIG. 5 in that it does not have guide grooves 3r and stopper members 3s shown in FIG. 5 but has additional components as described below. Namely, in addition to the fact that the link arm 6 is linked at the top thereof to the base section 7b of the swing arm 7 as shown in FIG. 5, the arm section 7c of the swing arm 7 extending from the base section 7b is connected at the distal end thereof to the proximal end 10a of an extension arm 10 by means of a point pin 7i In the fully opened position, the extension arm 10 is aligned with the arm section 7c of the swing arm 7. For this, the proximal end 10a of the extension arm 10 is inserted into the gap 7e formed in the arm section 7c such that the extension arm 10 is held aligned with the arm section 7c and prevented

from turning further as the extension arm 10 abuts the folded edge 7j f the arm section 7c but can be turned back in the opposite direction indicated by arrow R in FIG. 7 until it is partly received in the gap 7e. The distal end 10b of the extension arm 10 is pivotably linked to the anchor pin bearing 8 by means of an anchor pin 10c, said anchor pin bearing 8 being rigidly secured to the inner surface of the door proper 1e of the door proper 1e of the pull-down-and-open type door D1 by means of screws. The pull-down-and-open type door having the above described configuration operates as in a manner as described below by referring to FIGS. 6A and 6B. When the door is closed as shown in FIG. 6A, the arm section 7c of the swing arm 7 and the link arm 6 are held aslant to expand the compression springs 4 as they are bent relative to each other at the pivot point P linking the link arm 6 and the base section 7b of the swing arm 7. Under this condition, the pivot point P is located closer to the door relative to the vertical axial line L1 connecting the pivot pin 6a and the arm spindle 7a.

More specifically, the compression springs 4 urge the movable spring holder 5 upward in the fitting case 3 and the extension arm 10 has been turned at the joint pin 7i toward the lateral side of the arm section 7c that is closer to the door 1e, while the link pin 6b is located closer to the door relative to the vertical axial line L1 so that consequently the base section 7b of the swing arm 7 is urged to rotate in the direction of arrow R1 by the resilient force of the compression springs 4 and hence the door 1e is constantly pulled toward the opening 1k by the extension arm 10 to maintain the door 1e in the closed state.

When the closed door 1e is pulled down by holding the upper end thereof by hand to make it rotate round the hind 1d, the extension arm 10 is also pulled with the door by way of the anchor pin bearing 8 to increase the angle Θ 1 between the arm section 7c and the anchor pin bearing 8 so that the link arm 6 lowers the movable spring holder 5 to compress and increase the resilient force of the compression springs 4 for pushing the door 1e open. As a result, the door 1e rotates downward to its fully open position as shown in FIG. 6B while being subjected to a damping effect of the unit.

When the door is fully opened and the angle Θ 1 between the arm section 7c and the anchor pin bearing 8 gets to its maximum value of 180 degrees, the extension arm 10 abuts the folded edge 7j of the arm section 7c to maintain the aligned condition of the arm section 7c and the extension arm 10, where the door 1e is flush with the bottom wall 1m of the cabinet 1a. Note that it is so arranged that the pivot point P turns downward substantially onto the vertical axial line L1 under this condition. Thus, when the door is fully opened, the compression springs 4 are sufficiently compressed but the resilient force of the compression springs 4 is not transmitted to the base section 7b way of the link pin 6b so that the door 1e is safe in its fully open position as it is not subjected to any excessive force.

A pull-down-and-open type cabinet door prop unit according to the sixth aspect of the invention is realized by linking the rotary shaft 9a of a damper mechanism 10 designed to dampen the opening motion or the opening and closing motion of the door 1e by means of viscous fluid

to a door prop unit according to the fifth aspect of the invention. Note that, if the damper mechanism 10 is made available only for the door opening motion by means of a one-way clutch (not shown), the door opening motion of the door using this door prop unit will become further slow and smooth when compared with the above described door prop unit of the fifth aspect of the invention.

Now, a pull-up-and-open type top door prop unit according to the seventh aspect of the invention will be described. FIGS. 8A and 8B illustrate a pull-up-and-open type top door D2 under consideration. There is also shown a cabinet 1a comprising an opening 1k facing upward, a front wall 1p, a rear wall 1q, a pair of lateral walls and a bottom wall. The door proper 1e is swingably secured to the upper edge of the rear wall 1q by means of a hinge 1d. The illustrated embodiment of door prop unit is essentially identical with the one described above in terms of the fifth aspect of the invention and by referring to FIGS. 6A and 6B, although the fitting case 3 is arranged horizontally and fitted to the inner surface 1j of one of the lateral walls at a position close to the corner defined by the opening 1k and the rear wall 1q by means of screws 2. In this case again, the distal end 10b of the extension arm 10 is pivotably fitted by means of an anchor pin 10c to the anchor pin bearing 8 arranged on the lower surface of the door 1e. Thus, the movable spring holder 5 is horizontally movable and urged toward the front wall 1p by the compression springs 4. It is pivotably linked to the link arm 6 by means of a pivot pin 6a at a position relatively close to the real wall 1q, which link arm 6 is by turn pivotably linked to the base

section 7b of the swing arm 7 by means of a link pin 6b. The link pin 6b and the arm spindle 7a of the swing arm 7 are located relatively close to the front wall 1p. This arrangement according to the seventh aspect of the invention differs from that of the fifth aspect of the invention in that, when the pull-up-and-open type cabinet door D2 is closed and hence the arm section 7c and the extension arm 10 are oblique relative to each other to compress the compression springs 4 as shown in FIG. 6A, the pivot point P of the link arm 6 and the base section 7b of the swing arm 7 of the former arrangement is located between the pivot pin 6a and the arm spindle 7a and slightly away from the door 1e relative to the horizontal axial line L2 connecting the pivot pin 6a and the arm spindle 7a. Thus, as long as the door is closed, the link arm 6 is urged toward the front wall 1p by the strong resilient force of the compression springs 4 to exert a relatively small rotary force onto the base section 7b in the direction of arrow R2 so that the upper edges of cabinet surrounding the opening 1k does not have to bear the entire weight of the door 1e. In other words, the door held closed while the weight of the door 1e less the rotary force is applied to the upper edges of the cabinet surrounding the opening 1k. Then, as the front edge of the door 1e is turned upward by hand to open the door 1e, the angle Θ 2 between the arm section 7c and the anchor pin bearing 8 is increased and the link arm 6 pushes the movable spring holder 5 toward the front wall 1p to expand the compression springs 4 so that consequently the door 1e can be opened with little effort due to the resilient force of the compression springs 4. When the door is fully opened and the angle Θ 1 gets to its maximum

value of 180 degrees as shown in FIG. 8B, the extension arm 10 and the arm section 7c are held to an aligned state and the door 1e is standing almost upright. Note that, with the above described embodiment of door prop unit, the link pin 6b is positionally so arranged relative to the base section 7b that the compression springs 4 is expanded to move the pivot point P closer to the front wall 1p than the arm spindle 7a and away from the door relative to the horizontal axial line L2 as the movable spring holder 5 is moved sideways toward the front wall 1p of the cabinet.

Thus, the resilient force of the compression springs 4 is exerted onto the swing arm 7 in the direction of arrow R2 to securely maintain the door in the fully opened state.

When the door 1e is turned downward from the fully opened state to make the arm section 7c and the extension arm 10 become oblique relative to each other, the load of the moving door is applied to the swing arm 7 to rotate it in the direction opposite to that indicated by arrow R2 as the load increases with the closing motion of the door 1e and the compression springs 4 are compressed as the movable spring holder 5 is moved sideways toward the rear wall 1q so that consequently the door 1e slowly and gradually moves downward to its fully closed state under the braking effect of the compression springs 4.

As in the case of the fifth and sixth aspects of the invention, a pull-down-and-open type top door prop unit according to the eighth aspect of the invention is realized by linking the rotary shaft 9a of a damper mechanism 10 designed to dampen the opening motion or the opening and closing motion of the door 1e by means of viscous fluid to a

door prop unit according to the seventh aspect of the invention. Note that, if the damper mechanism 10 is made available only for the door opening motion by means of a one-way clutch (not shown), the door opening motion of the door using this door prop unit will become further slow and smooth when compared with the above described door prop unit of the seventh aspect of the invention. Additionally, the damping effect of the damper mechanism 10 may be exploited for both opening and closing the door. If such is the case, while the resilient force of the compression springs 4 for increasing the door closing effect is reduced by the damping effect of the damper mechanism when the door is opened, this disadvantage can be minimized by maximizing the resilient force to be used for increasing the door closing effect.

Now, a pull-up-and-open type door prop unit according to the ninth aspect of the invention will be described. FIGS. 9 through 11 illustrate a pull-up-and-open type door D3 under consideration. There is shown a cabinet 1a comprising an opening 1k facing forward and a top wall 1b. The door proper 1e is swingably secured to the upper edge of the top wall 1b by means of a hinge 1d.

The illustrated embodiment of door prop unit is essentially identical with the one described above in terms of the fifth aspect of the invention and by referring to FIGS. 6A and 6B, although the fitting case 3 is arranged upside down and fitted to the inner surface 1j of one of the lateral walls in an upper portion thereof close to the opening 1k. Thus, the movable spring holder 5 is vertically movable as it is urged by the compression springs 4 and the link arm 6 is pivotably linked at the upper

end thereof to the movable spring holder 5 by means of a pivot pin 6a and at the lower end thereof to the base section 7b of the swing arm 7 by means of a link pin 6b, said base section 7b being rotatable around an arm spindle 7a.

As described above for the preceding aspects of the invention, an extension arm 10 is linked at the proximal end thereof to the arm section 7c of the swing arm 7 by means of a joint pin 7i and at the distal end thereof to the anchor pin bearing 8 rigidly secured to the door 1e by means of an anchor pin 10c. When the door is closed and the arm section 7c and the extension arm 10 are oblique relative to each other to compress the compression springs 4 as shown in FIG. 9, the pivot point P of the link arm 6 and the base section 7b of the swing arm 7 is located closer to the door relative to the vertical axial line L1.

Thus, when the door is closed, the base section 7b is urged to rotate in the direction of arrow R3 by the link arm 6 under the effect of the resilient force of the compression springs 4 and consequently the arm section 7c is urged to rotate in the direction of arrow R4 so that the door 1e is held to the closed state.

Now, if the door 1e is pulled upward to open by the user who is holding the lower end of the door, the pivot point P is moved onto the vertical axial line L1 in the initial stages of the door opening motion as shown in FIG. 10 to provide a change point for the door prop unit, where no rotary force is applied to the door 1e both in the door opening motion and in the door opening motion. After passing by the change point, the door opening motion gets into the subsequent stages until the door

becomes fully opened, when the arm section 7c and the extension arm 10 are aligned to expand the compression springs 4 and the pivot point P is located away from the door relative to the vertical axial line L1 as shown in FIG. 11 to transmit a rotary force trying to open the door to the door so that the door is held to its opened position.

The door can be moved from the fully opened position toward the closed position simply by releasing the arm section 7c and the extension arm 10 from the aligned state. Then, the door 1e is closed by its own weight, although the swing arm 7 is swung reversely to push up the movable spring holder 5 by way of the link arm 6 and compress the compression springs 4 so that consequently the door 1e is closed very slowly and, once it get to the completely closed position, it maintains the closed state.

A pull-up-and-open type door prop unit according to the tenth aspect of the invention is realized by adding a damper mechanism 9 to a door prop unit according to the ninth aspect of the invention and, therefore, its effects are substantially same as those described above by referring to the sixth and eighth aspects of the invention.

Now, a pull-sideways-and-open type door prop unit according to the eleventh aspect of the invention will be described. FIGS. 12 through 14 illustrate a pull-sideways-and-open type door D3 in cross section under consideration. There is shown a cabinet 1a comprising a pair of oppositely disposed lateral walls 1p and 1q, a top wall (not shown) and a bottom wall 1m that define an opening 1k facing forward. The door proper 1e is swingably secured to the front edge 1s of the

lateral wall 1q by means of a hinge 1d.

The illustrated embodiment of door prop unit is essentially identical with the one described above by referring to FIG. 9, although the fitting case 3 is rigidly secured to inner surface of the top wall and/or that of the bottom wall 1m. Thus, the movable spring holder 5 is urged toward the lateral wall 1p by the compression springs 4 and the extension arm 10 is pivotably linked to the anchor pin bearing 8 on the door. When the door is in the completely closed state as shown in FIG. 12, the arm section 7c and the extension arm 10 are oblique relative to each other but the compression springs 4 are expanded to urge the movable spring holder 5 toward the lateral wall 1p so that the pivot pin P where the link arm 6 and the base section 7b of the swing arm 7 are linked by means of a link pin 6b is located closer to the door relative to the horizontal axial line L2.

Thus, in the closed state of the door, the base section 7b is driven to rotate in the direction of arrow R5 by the link arm 6 under the effect of the relatively small resilient force of the compression springs 4 and the arm section 7c is driven to rotate in the direction of arrow R6 to maintain the door 1e under the closed state.

If, under this condition, the door 1e is turned sideways to open, it gets into the initial stages of the door opening motion as shown in FIG. 13, where the pivot point P is moved onto the horizontal axial line L2 to provide a change point. After passing by the change point, the door opening motion gets into the subsequent stages until the door becomes fully opened, when the arm section 7c and the extension arm 10 are

aligned to expand the compression springs 4 and the pivot point P is located away from the door relative to the horizontal axial line L1 as shown in FIG. 14 to transmit a rotary force trying to open the door to the swing arm 7 so that the door is held to its opened position. The door 1e and the opening of the cabinet preferably shows an angle greater than 90 degrees in the fully opened position of the door as shown in FIG. 14.

The door can be moved from the fully opened position toward the closed position simply by releasing the arm section 7c and the extension arm 10 from the aligned state shown in FIG. 14 to an obliquely positioned state shown in FIG. 13. Then, the door 1e is automatically closed and held to the closed state under the effect of the resilient force of the compression springs 4 as described earlier.

A pull-sideways-and-open type door prop unit according to the twelfth aspect of the invention is realized by adding a damper mechanism 9 to a door prop unit according to the ninth aspect of the invention and, therefore, its effects are substantially same as those described above by referring to the sixth, eighth and tenth aspects of the invention.

Now, a pull-up-and-store-under-the-top type door prop unit according to the eleventh aspect of the invention will be described. FIGS. 15 through 17 illustrate a pull-up-and-store- under-the-top type door D8 in cross section under consideration that has functionally much in common with a pull-up-and-open type door D3 described above by referring to FIGS. 9 through 11. There is shown a cabinet 1a comprising a pair of oppositely disposed lateral walls, a rear wall, a top wall 1b and a bottom wall that define an opening 1k facing forward. A sliding rail

assembly 11 is horizontally arranged on the inner surface 1j of one of the lateral walls, running from the opening 1k toward the rear wall of the cabinet 1a.

The sliding rail assembly 11 comprises an outer rail 11a rigidly secured to the inner surface 1j of the lateral wall and an inner rail 11b, to which a bracket 12 is rigidly fitted at a position close to the opening 1k of the cabinet by means of screws 12a.

As shown in FIG. 17, said bracket 12 has a horizontal member 12b to be fitted to the top wall and an upright member 12c to show an inverted L-shape. There is also provided a sliding hinge mechanism 13 comprising a base member 13a fitted to the lower surface of the horizontal member 12b. Said inner rail 11b is rigidly secured to the outer surface of the upright member 12c of the bracket 12.

A fitting cup 13d is pivotably linked to the base member 13a of the sliding hinge 13 by way of first and second link members 13b and 13c and the door 1e and the bracket 12 are connected together by means of the sliding hinge mechanism 13. Reference symbols 13e, 13f, 13g and 13h in FIGS. 15 through 17 denote link pins of the first and second link members 13b and 13c.

As shown in FIG. 15, a pair of revolving members 12d and 12e are rotatably fitted to respective lower lateral portions of the upright member 12c of the bracket 12 by means of respective vertical pins 12d' and 12e'. As shown in FIG. 17, the revolving members 12d and 12e are made to revolvably abut the inner surface 1j of the lateral wall.

Reference numeral 14 denotes a door bearing roller

revolvably held by a horizontal spindle 14a extending between the inner surfaces 1j of the lateral walls. As will be described hereinafter, the door 1e is horizontally pushed into the cabinet 1a for storage as it moves on the door bearing roller 14.

Thus, with a cabinet door prop unit according to the thirteenth aspect of the invention, the fitting case 3 is not directly fitted to the inner surface of one of the lateral walls of the cabinet but rigidly secured to the upright member 12c of the bracket 12 by means of screws 2. Otherwise, it is like the one illustrated in FIG. 4 for an over-the-top type cabinet door and arranged upside down relative to the one illustrated in FIG. 6 for a pull-down-and-open type cabinet door and the distal end 10b of the extension arm 10 is linked to the anchor pin bearing 8 on the door 1e by means of an anchor pin 10c.

When the door is closed as shown in FIG. 13, the arm section 7c and the extension arm 10 are oblique relative to each other to compress the compression springs 4 and the pivot point P linking the link arm 6 and the base section 7b of the swing arm 7 is located closer to the door relative to the vertical axial line L1.

Thus, the base section 7b is urged to rotate in the direction of arrow R7 by the resilient force of the compression springs 4 and hence the door 1e is held to its closed position. As the door 1e is pulled up to open by the user holding the lower end thereof, the pivot point P is moved onto the vertical axial line L1 to provide a change point there in the initial stages of the door opening motion as shown in FIG. 10. Then, after the pivot point P passes by the change point in the subsequent

stages of the door opening motion, the arm section 7c and the extension arm 10 become aligned with each other to hold the door 1e in a horizontal state as shown in FIG. 16.

Note that the opening motion of the door 1e is provided by the rotary operation of the first link member 13b, the second link member 13c and the fitting cup 13d. The compression springs 4 are expanded and the pivot point P is moved away from the door relative to the vertical axial line L1 to urge the swing arm 7 to rotate and open the door until the door is brought to a horizontal position and become fully opened so that the door is held to its fully opened and horizontal position after the sliding hinge mechanism 13 stops rotating.

Then, as the door 1e shown in FIG. 16 is pushed in the direction of arrow R8, the lateral pushing force is transmitted to the bracket 12 by way of the sliding hinge mechanism 13, the swing arm 7 and the fitting case 3 so that the bracket 12 is moved into the cabinet 1a by the sliding motion of the inner rail 11b along the outer rail 11a of the sliding rail assembly 11 and the revolving motion of the revolving members 12d and 12e arranged on the bracket 12. Thus, the horizontally positioned door 1e is also moved into the cabinet 1a along the direction of arrow R8 in FIG. 18 until it is completely housed in the cabinet 1a as it is supported at the lower surface thereof by the door bearing roller 14 that is also revolving.

For closing the door housed in the cabinet, the user simply has to pull out the door 1e from the cabinet 1a and then release the arm section 7c and the extension arm 10 from the aligned condition. Then,

as the door 1e turns downward by its own weight, the swing arm 7 is swung reversely to move up the movable spring holder 5 by way of the link arm 6 to consequently compress the compression springs 4 so that the closing motion of the door 1e is made very slow and, once the door is closed, it is held to its closed position.

A pull-up-and-store-under-the-top type door prop unit according to the fourteenth aspect of the invention is realized by adding a damper mechanism 9 to a door prop unit according to the ninth aspect of the invention and, therefore, its effects are substantially same as those described above by referring to the sixth, eighth and tenth aspects of the invention.

[Advantages of the Invention]

As described above in detail, according to the first aspect of the invention, there is provided an over-the-top type cabinet door that can be used smoothly once the fitting case of the cabinet door prop unit is rigidly fitted to the inner surface of one of the lateral walls of the cabinet and the distal end of the swing arm of the unit is pivotably fitted to the door in a simple operation. With such an arrangement, the door prop unit has a neat appearance and is free from the risk of smashed fingers.

Additionally, since the door prop unit comprises compression springs urging the swing arm by way of a link mechanism, the door may be opened and stored easily on the top wall of the cabinet easily and opened very slowly.

According to the second aspect of the invention, since a cabinet door prop unit as described above in terms of the first aspect of the

invention is provided with a damper mechanism, the swing motion of the swing arm is damped and slowed without requiring any user's effort when the cabinet door is closed.

With an over-the-top type cabinet door prop unit according to the third aspect of the invention, the door is totally free from the resilient force of the compression springs in the subsequent stages of the door opening motion until the door is placed on the top wall of the cabinet so that the door can be handled in an appropriate manner when it is stored on the top wall and pulled out with little effort from the top wall.

According to the fourth aspect of the invention, the additional effect as described above for the second aspect of the invention is also obtained because a damper mechanism is combined with a door prop unit according to the third aspect of the invention.

According to the fifth aspect of the invention, there is provided a pull-down-and-open type cabinet door that can be used smoothly once the fitting case of the cabinet door prop unit is
rigidly fitted to the inner surface of one of the lateral walls of the cabinet and the distal end of the swing arm of the unit is pivotably fitted to the door in a simple operation. With such an arrangement, the door prop unit has a neat appearance and is free from the risk of smashed fingers.

According to the sixth aspect of the invention, the additional effect as described above for the second aspect of the invention is also obtained because a damper mechanism is combined with a door prop unit according to the fifth aspect of the invention.

According to the seventh aspect of the invention, the door prop

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unit is so arranged that the compression springs are compressed when the door is closed and expanded when the door is opened and the pivot point of the link pin is moved appropriately relative to the horizontal axial line in the door opening and closing motion. Thus, a pull-up-and-open type top cabinet door according to this aspect of the invention can be securely held in the closed or opened state and the door closing motion can be conducted very slowly.

According to the eighth aspect of the invention, the additional effect as described above for the second aspect of the invention is also obtained because a damper mechanism is combined with a door prop unit according to the seventh aspect of the invention.

With a door prop unit for a pull-up-and-open type front side cabinet door according to the ninth aspect of the invention, the pivot point is moved appropriately relative to the vertical axial line and the compression springs are expanded and compressed respectively when the door is opened and closed so that the door is securely held to its closed position and a change point is provided for the initial stages of the door opening motion. With the arrangement, the subsequent stages of the door opening motion and all the stages of the door closing motion are aided by the compression springs. Additionally, the door can be securely held to the opened position and the operation of closing the door can be conducted very slowly.

According to the tenth aspect of the invention, the additional effect as described above for the second aspect of the invention is also obtained because a damper mechanism is combined with a door prop unit

according to the ninth aspect of the invention.

With a pull-sideways-and-open type cabinet door according to the eleventh aspect of the invention, the compression springs are expanded when the door is closed and compressed when the door is opened and the fitting case is rigidly secured either to the top wall or the bottom wall in addition to the arrangement that the pivot point is moved appropriately relative to the horizontal axial line. Thus, the net effect is substantially same as its counterpart for the fifth aspect of the invention.

According to the tenth aspect of the invention, the additional effect as described above for the second aspect of the invention is also obtained because a damper mechanism is combined with a door prop unit according to the ninth aspect of the invention.

With a pull-up-and-store-under-the-top type cabinet door prop unit according to the thirteenth aspect of the invention, once a bracket arranged on a sliding rail mechanism is rigidly secured to the cabinet and linked to a hinge and slide mechanism and the extension arm is pivotably fitted to the anchor pin bearing of the door in a simple operation, the door can be held to its closed position and the subsequent stages of the door opening motion are aided by the compression springs all the way to the horizontal position of the door. Additionally, the operation of storing the door under the top wall can be conducted easily and the door can be closed very slowly.

According to the fourteenth aspect of the invention, the additional effect as described above for the second aspect of the invention is also obtained because a damper mechanism is combined with a door

prop unit according to the thirteenth aspect of the invention.

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